

NCMS ESS 2000 PROJECT

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ESS 2000

**Advancing the State-of-the-Art in
Environmental Stress Screening**

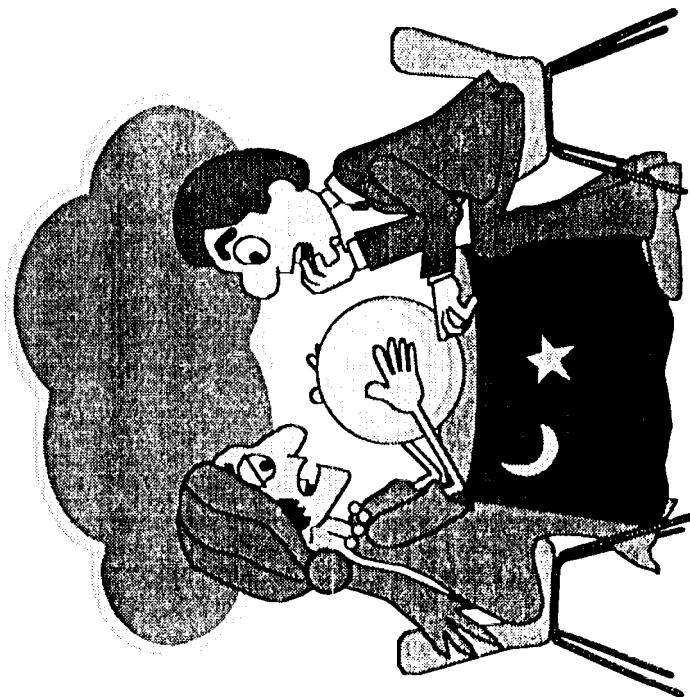


Agenda

- ESS 2000 vision statement
- ESS definition
- Drivers
 - Objectives
- Participants
- Project description
- Technologies description
- Deliverables
- Summary

WESS 2000 Vision Statement

Enhance the knowledge necessary to implement cost-effective, leading-edge ESS technologies and procedures in order to increase U.S. electronics industry competitiveness



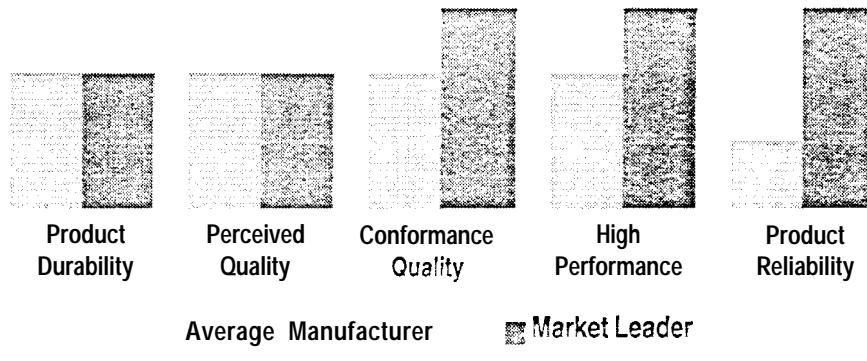
ESS Definition

Environmental Stress Screening (ESS) of electronic hardware is a manufacturing process performed to identify and segregate those items (part, module, subassembly, box, or system) defined as defective. Appropriate environmental stresses are chosen to force latent defects that would otherwise fail in the field into observable failures in the factory. These stresses may be unrelated to mission, use, or qualification levels.

Project Drivers

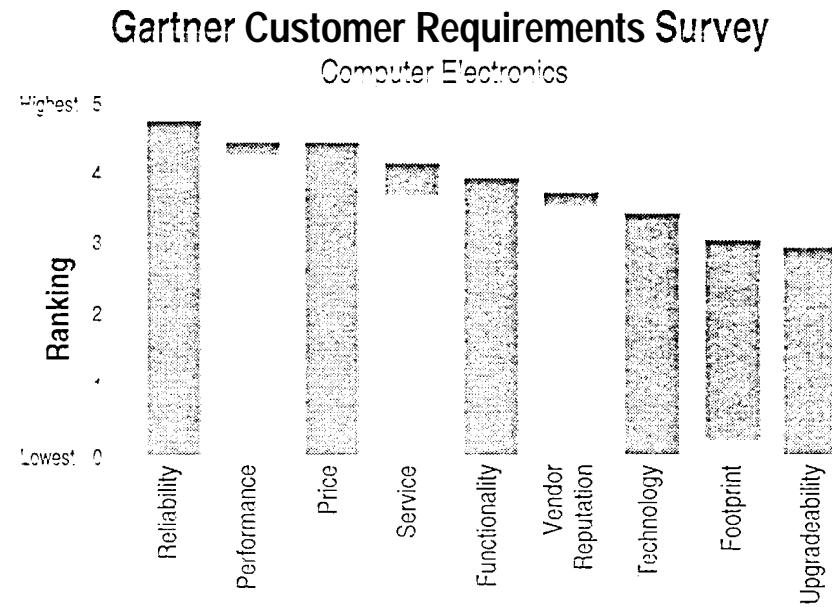
- Market competitiveness
- Product quality/reliability
- Time to market
- Significant \$ and time devoted to ESS development and processes
- Tool for process improvement and new product process development

Gaining Competitive Advantage Through Product Quality



Deloitte & Touche, Competing in the Electronics Industry

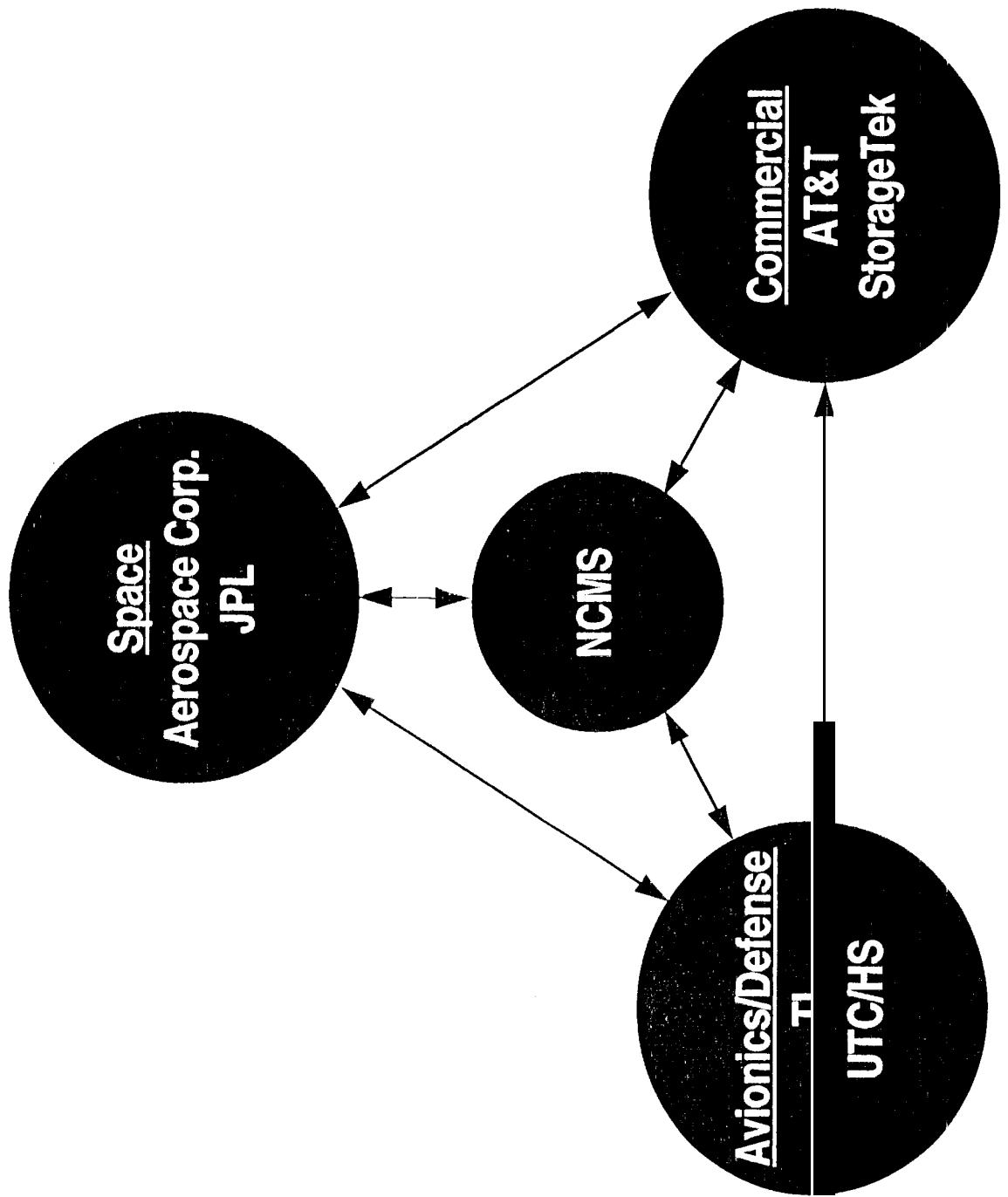
Project Driver: Product Quality/ Reliability



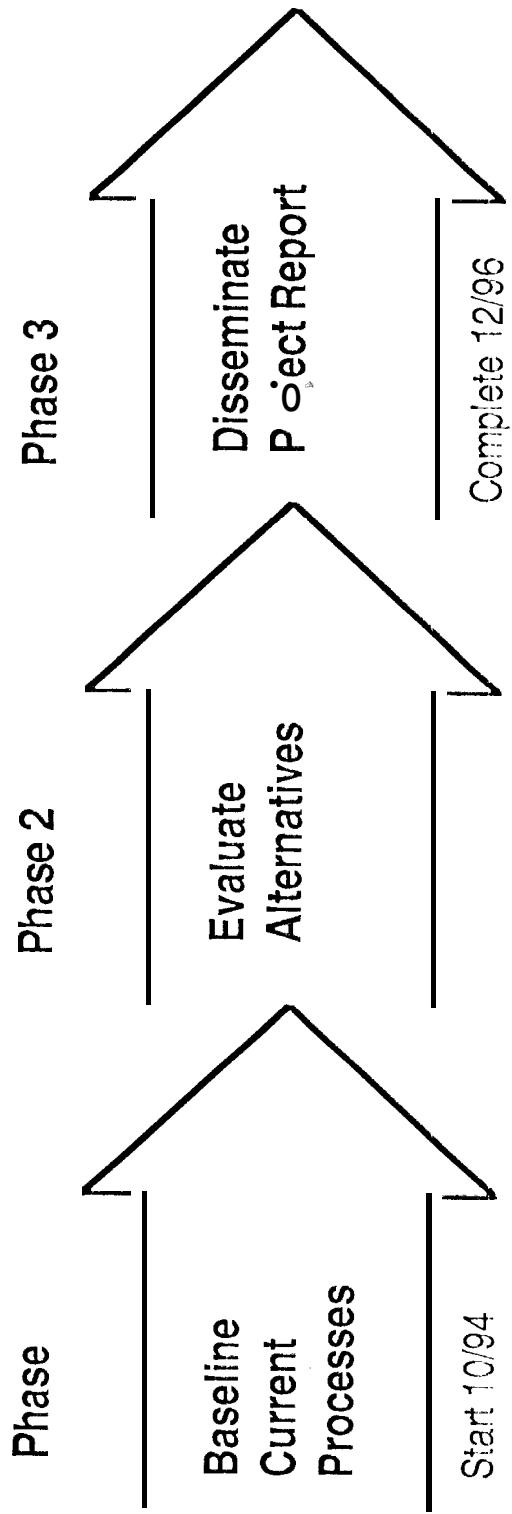
Project Objectives

- Establish and compare baseline processes
 - cost
 - Cycle time
 - Failure mechanisms
- Utilize resources of multiple companies
- Develop common database to collect process and failure data
- Use value added screening effectiveness (VASE) matrix to evaluate and enhance leading-edge ESS technologies
- Disseminate results to industry

Project Participants



ESS 2000 Project Description



- Preliminary work
- Establish database
- Collect data
- Safety of screen test
- Develop VASE
- LESS solder joint life test
- Secure hardware
- Perform alternative ESS
- Perform design of experiments
- Collect & evaluate field reliability data
- Generate final report
- Transfer technology

Project Technologies Description

- Key Screening Stresses
- Pneumatic HALT/HASS
- Electrodynamics HALT/HASS
- Liquid Environmental Stress Screening (LESS)
- Value Added Screening Effectiveness (VASE) Matrix

Key Screening Stresses

- Temperature ramp rates and levels
- Dwell times
- Vibration levels/types
- Voltage margining
- Frequency margining
- Combinational stresses
- Stress order/level

Pneumatic HALTMASS

- Highly accelerated ESS employs combined stresses that exceed those experienced in traditional ESS
- Typical equipment capability:
 - Simultaneous application of stresses
 - Multi-axis vibration
 - 20 to 60°C/min ramp rates
 - Power/frequency/voltage cycling
 - Functional testing

Electrodynamic HALT/HASS

- Uses combined stresses described previously but employs electrodynamics vibration in lieu of pneumatic vibration
- Typical equipment capability:
 - Simultaneous application of stresses
 - Single-axis vibration
 - User-tailorable autospectrum
 - 20 to 60°C/min ramp rates
 - Power/frequency/voltage cycling
 - Functional testing

Liquid Environmental Stress Screening (L_{ES}SS)

- Applies environmental stresses to a product through the use of an inert, non-conductive fluid
- Typical equipment capability:
 - Liquid-to-liquid shock (-20 to +80°C)
 - Simultaneous voltage margining
 - 500 to 1000°C/min ramp rates
 - Functional testing

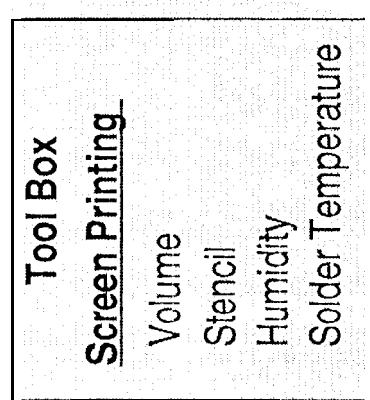
Value Added Screening Effectiveness (VASE) Matrix

- A tool that ranks the effectiveness of ESS processes based upon:
 - Product characterization data
 - Process tracking data
 - Anomaly investigation data
 - Field failure data

VasS (continued)

Failure Mode	Solder #1	Solder #2	Lifted lead	Wire bond	
ICT	.4				LESS
ESS #2					ED ESS
ESS #3					ES
ESS #1					

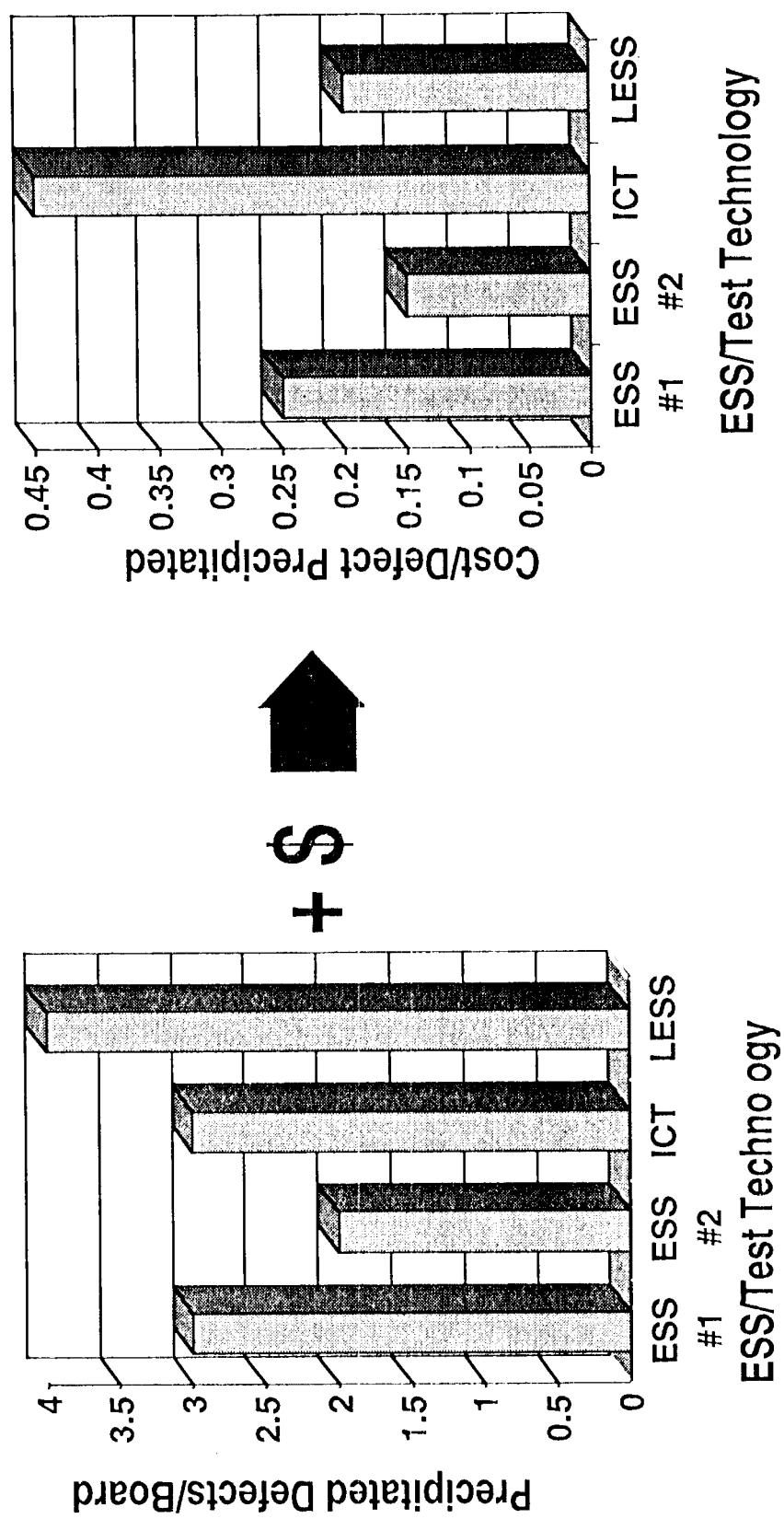
ESS/Test Technology



Manufacturing Process/ Technology



VASE (continued)



Project Deliverables

- NCMS proprietary ESS 2000 database
- Objective evaluation of ESS technologies
- Value added screening effectiveness matrix (optimization tool)
- Final report

Summary

- Project aims to enhance the knowledge necessary to implement cost-effective, leading-edge ESS technologies and procedures
- Compare effectiveness of baseline ESS processes to alternatives
- Utilize multiple companies to evaluate leading-edge ESS technologies
 - Pneumatic HASS
 - LESS
 - Electrodynamic HASS
- Disseminate project report